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FOREST INSECT INVESTIGATIONS

DAMAGE TO SEASONED YELLOW PINE LUMBER BY A BARK LOOSENER, CALLIDIUM ANTENNATUM NEWM.

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Introduction

Damage by a roundheaded borer to seasoned yellow pine lumber stored in open yards has recently become a factor in the yards of several mills located in northern California. Practically all the reported trouble has originated in mills located on the eastern slope of the Sierra Nevadas, within a few miles of the forest. The nature of the damage consists of larval mines, which score the surface of the sapwood and extend down into the wood to a depth of two or three inches. It has been found to occur only in sapwood that has been sawn so as to leave bark strips adhering to the wood after the lumber was piled in the yards.

The insect responsible for this trouble has been found to be a cerambycid borer, determined by Mr. W.S. Fisher as Callidium antennatum, var. hesperum, Casey; it has been commonly termed the "bark loosener". This species is common in western forests, where it attacks the logs and limbs of dead yellow pine and sugar pine. Very closely allied species occur in white fir, Douglas fir, incense cedar and juniper. It has also been found to injure seasoned rustic work by mining out the cambium layer, causing the bark to loosen on the log.

Description of the Insect and Its Work

a. General Appearance and Habits

The adult is a flat, bluish-black beetle, from 0.4 to 0.6 of an inch in length. The larva, a yellowish-white grub about 0.8 of an inch in length when full-grown, attacks seasoned lumber and logs by feeding between the bark and the wood. When mature, the larva bores into the wood to make a gallery, in which it overwinters and transforms to the adult-beetle stage. This gallery, which is about three-eighths of an inch in diameter and four inches in length, causes the major injury to the lumber.

The adult female beetle starts the attack during the spring flight period by depositing eggs on the bark surface. Although very little is known of the egg-laying habits of this insect, it is evident that the egg is laid in a bark crevice as close to the inner bark as possible. Unless a strip of bark adheres to the wood the attack is unsuccessful, as no larvae have been found to develop in lumber or logs from which the bark has been entirely removed.

After hatching from the eggs the larvae work their way into the layer between bark and sapwood, where they start the first active feeding. In the early stages, during June and July, the larvae are so small that they are hardly noticeable. In feeding, each larva cuts a flat, irregular burrow between bark and wood. These galleries, which increase in size with the growth of the larvae, have no definite form, and are packed with a fine, granular sawdust. The surface of the inner bark is mined, and the surface of the sapwood scored to a depth of from one-sixteenth to one-eighth of an inch.

Where lumber is piled in open yards the larvae grow rapidly during July and August and are nearly mature by September 1. They then enter the wood to form the overwintering galleries, where the change to pupae and later to new adults takes place. In making these overwintering galleries each larva first bores in at right angles to the surface of the sapwood to a depth of about two inches, then makes a right-angled turn and extends the gallery for another two inches parallel to the surface of the sapwood. The terminal portion of the gallery is slightly enlarged to form a cell, in which pupation takes place. The larva walls itself up in the terminal of the gallery by closing the entrance to this cell with a plug of loose sawdust. However, before shutting itself in, the larva cuts a gallery through the bark almost to the outer bark scales, directly above the point where the overwintering gallery starts down into the sapwood. This procedure provides for the emergence of the adult beetle, which does not possess strong wood-cutting mandibles and is unable to cut its way through the outer bark.

The overwintering period lasts through the late fall, winter and early spring months. This period is spent both as prepupal larvae and pupae, the majority of the brood overwintering as pupae. New adults begin to form early the following spring and emerge before the last of May.

b. Number of Annual Generations

In the yellow pine region of the Sierra Nevada Mountains there is but one complete generation annually of this insect. Observations by Mr. A.A. Lund of the Lassen Lumber & Box Company at Susanville, California, indicate that in 1927 the adult beetles started to emerge about May 1, and were seen flying in the lumber yards from May 15 to June 15. A few stragglers were flying as late as July 1.

Observations by Dr. E.C. Van Dyke of the University of California indicate that in the warmer localities west of the Sierra Nevada Mountains the emergence may occur at least one month earlier, as he has observed adults flying early in April.

At Susanville the larval feeding extended through July and August, and the larvae had matured, entered the wood and formed the overwintering gallery by September 15. The majority of the brood passed the winter in the pupal stage, but a few prepupal larvae were found. New adults formed during April and emerged in May.

It has been found that where infested stock is kept in temperatures above 50°, at least two generations develop annually. Infested boards containing prepupal larvae were collected at Susanville September 20, 1925, and were kept in the laboratory at Stanford University during 1927. Adults emerged from this stock in December 1925 and January 1927., These adults re--attacked the same stock, and larvae of the second generation were found feeding in April 1927. Emergence of this generation occurred during May, June and July.

Character of Damage in Seasoned Lumber

It is evident that under normal outdoor conditions lumber stock can become infested only while the beetles are in flight, during a relatively short period in May and June. The damage occurs entirely during the period of larval feeding, or during the months of July, August and September.

As these insects do not work in green cambium, their attack is made only on seasoned or partially-seasoned material, and occurs after the logs have passed through the mill. It is the lumber stock stored in the yards, which can be reached by beetles during the flight period, that is liable to attack.

New lumber stock that is exposed to the beetles in flight during May, June and early July of one season may be attacked and become infested during that season. Material placed in the yards after July 15 will not be attacked until the flight period of the following season.

The attack of one season is seldom heavy enough to exhaust entirely the cambium layer on which the young larvae feed. The beetles will re-attack, during the second season, the same material from which the adults have emerged. The longer the material remains in the yards the heavier may be the infestation and damage. This process of re-attacking will continue until the bark becomes entirely loosened from the wood and there is no longer food for the larvae.

Logs cut during the spring and early summer period are often characterized by a condition of the sap that causes the bark to "slip". On boards cut from logs of this type, small bark strips will loosen during the seasoning process. Such boards will not develop the larvae of Callidium and are free from damage.

The damage caused by the immature larvae before they enter the wood is of little consequence. The burrows only score the surface of the sapwood, and this injury is easily edged off during the process of surfacing in re-manufacture.

The more important phase of damage occurs after the larvae mature, and is caused by the overwintering gallery, which extends down into the sapwood. These holes degrade the stock for many of the purposes of re-manufacture. It is necessary to edge from three to four inches from the damaged board in order to remove this defect entirely.

In lumber which is piled close without stickers, a larva will sometimes extend a burrow for a distance of three or four feet, following the crack between two boards. This burrow will score the surface of both upper and lower boards. It occurs only where a very small amount of food material is available under the bark strips in the piled lumber. A larva which has consumed the material in one bark strip will go a considerable distance between the boards in search of more cambium surface in which to feed.

Evidence of Infested Stock

Evidence of infestation in the early stages is very difficult to detect. The egg and young larval stages are so tiny that they can be found only by a very close examination, aided by a magnifying glass. As the larvae become larger they can be easily seen by removing the bark. Granulated sawdust usually falls out under the bark, and this is the best indication of the infestation in lumber piles. When lumber is being inspected it is always advisable to tap any pieces on which there are bark strips to see if the bark has loosened or if the sawdust will fall out from under the strip.

Suggestions for Prevention and Control of Damage

This type of damage to lumber develops only in material to which there still adheres a certain amount of bark from the original log. By peeling the bark from the logs or by clean-edging the boards before they are placed in the lumber yards, it is possible to eliminate entirely the "bark loosener" as a source of damage to the stock.

However, for certain uses of the softer grades of western yellow pine it is desirable to save as much as possible of the outer sapwood in methods of manufacture. It is difficult to insure this utilization without leaving a certain amount of bark on the edges of boards in the initial sawing of the log. This bark cannot be conveniently removed until after the lumber is seasoned and remanufactured. Where this practice is desirable it is still possible to control, or at least greatly minimize, the damage caused by the bark loosener. This can be accomplished by close inspection and handling of the yards in which the stock is stored.

If the yards where the lumber is stored are within a few miles of the forest, the possibility of infestation cannot be entirely eliminated. A few beetles will probably fly in each season to attack susceptible material.

However, it is evident from conditions found at Susanville that infestation builds up locally where old lumber stock is not disposed of. Beetles emerging from the first season's attack on new stock re-attack heavily in the same lumber pile. Where piles containing considerable bark have been left in the yards for three or four years they become veritable centers of infestation, from which heavy attacks are made on any new material in the vicinity. It is therefore essential that the accumulation of susceptible old stock in the yards be avoided. Remanufacture of such stock and burning of the edgings will eliminate these centers of infestation.

If the infested material cannot be utilized it should be burned or treated so as to kill the broods. It is probable that high temperatures in a dry kiln will effectively kill all stages of the infestation, but no tests of this method of control have as yet been tried out.

New lumber stock placed in the yards after August 1 will not be subject to attack until the following May.

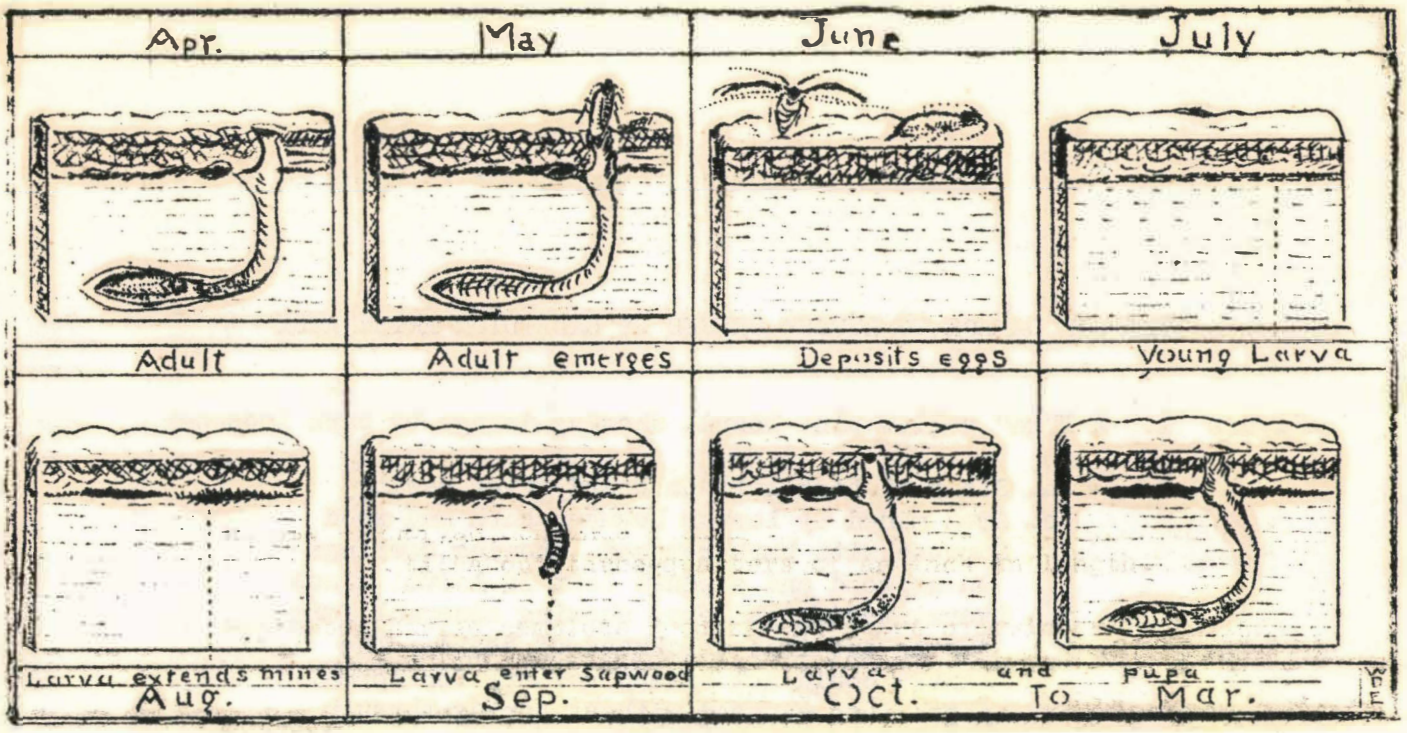
Stock that has been out in the yards during May, June and July should be watched for evidence of infestation. Shipments from stock that has been exposed during this period should be closely inspected to prevent passing or damaged boards to the purchaser. It is good practice to tap or cut into all bark strips for evidence of sawdust and larval mines. Until August 1 this evidence is very difficult to detect, but after that date the sawdust thrown out by the larvae becomes much more conspicuous.

The outstanding points to consider in dealing with the Callidium bark loosener are:

1. In the initial sawing of the log leave as little "wane" or bark strips on the boards as possible;

2. Remanufacture all stock containing considerable wane material that has stood in the open yards longer than one year. If this material has become infested, all larval mines should be edged out and the edgings burned;

3. Destroy or move from the yards all the old infested lumber piles that cannot be utilized.



LIFE HISTORY OF THE BARK LOOSENER (Callidium antennatum)
UNDER OPEN-YARD CONDITIONS ON THE LASSEN NATIONAL FOREST

April- - -Pupae in overwintering cells in sapwood; new adult beetles form during this period.

May - - - New adults emerge through gallery cut in outer bark by the larvae; flight period begins.

June - - -Eggs are deposited in crevices on outer bark; young larvae work their way into cambium layer between bark and wood, where feeding mines are started.

July- - - Young larvae feed between bark and wood, extending mines through the inner bark which also score surface of sapwood; these feeding mines are packed with fine granular sawdust.

August - -Larvae continue feeding and increase rapidly in size until about three-quarters of an inch in length.

September Larvae complete feeding and start overwintering gallery, which is extended into sapwood.

October
to March -Larvae and pupae lie dormant in overwintering cells in sapwood; majority of brood transform to pupae, but a few pass through winter as prepupal larvae.

TYPES OF DAMAGE TO LUMBER CAUSED BY CALLIDIUM ANTENNATUM

Figure I. A 1"x4" yellow pine board, showing damage by bark loosener

a. Strip of bark left on board after sawing.
b. Area mined by larvae between bark and wood
c. Sapwood with bark removed, showing scorings on sapwood and sawdust left in larval mines
d. Overwintering gallery, showing abnormal form due to one-inch thickness of board. The larvae could not extend gallery for normal depth into sapwood without boring through surface of board
e. Protective plug of borings
f. Prepupal larva in overwintering cell

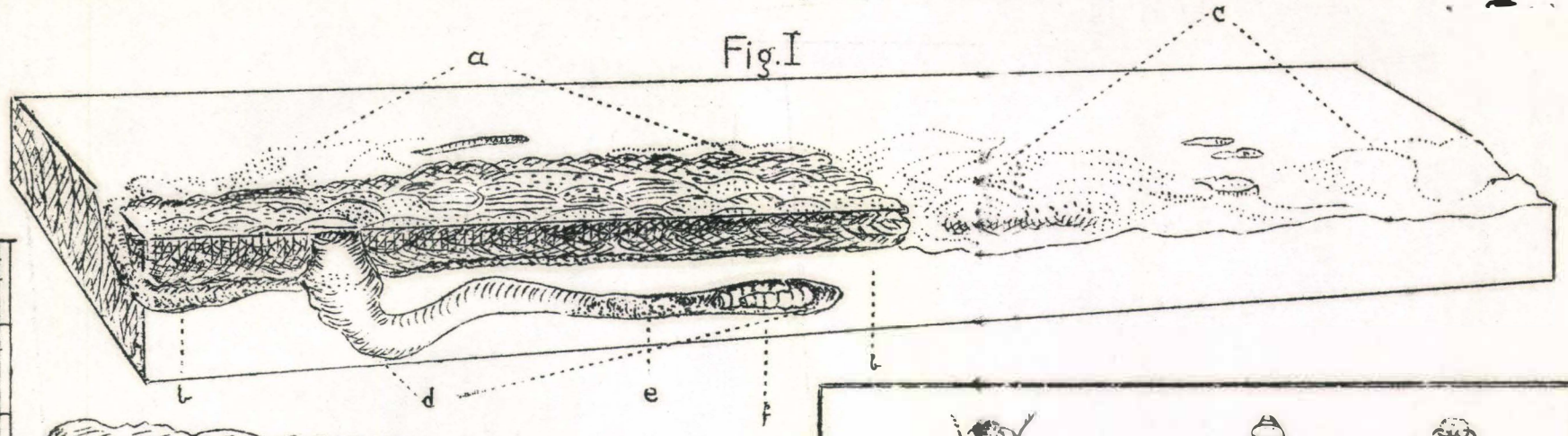
Figure II. A yellow pine edging cut radially from log, showing damage by bark loosener

a. Larval mines between bark and wood
b. Overwintering gallery
c. Extension of overwintering gallery through outer bark to provide for emergence of new adults
d. Pupa in overwintering cell

Figure III. Stages of bark loosener, Callidium antennatum

a. Adult, 4 : enlarged
a-1, natural size
b. Mature larva $3\frac{1}{2}$x enlarged
b-1, natural size
c. Pu $3\frac{1}{2}$ times enlarged
c-1, natural size

Fig. I



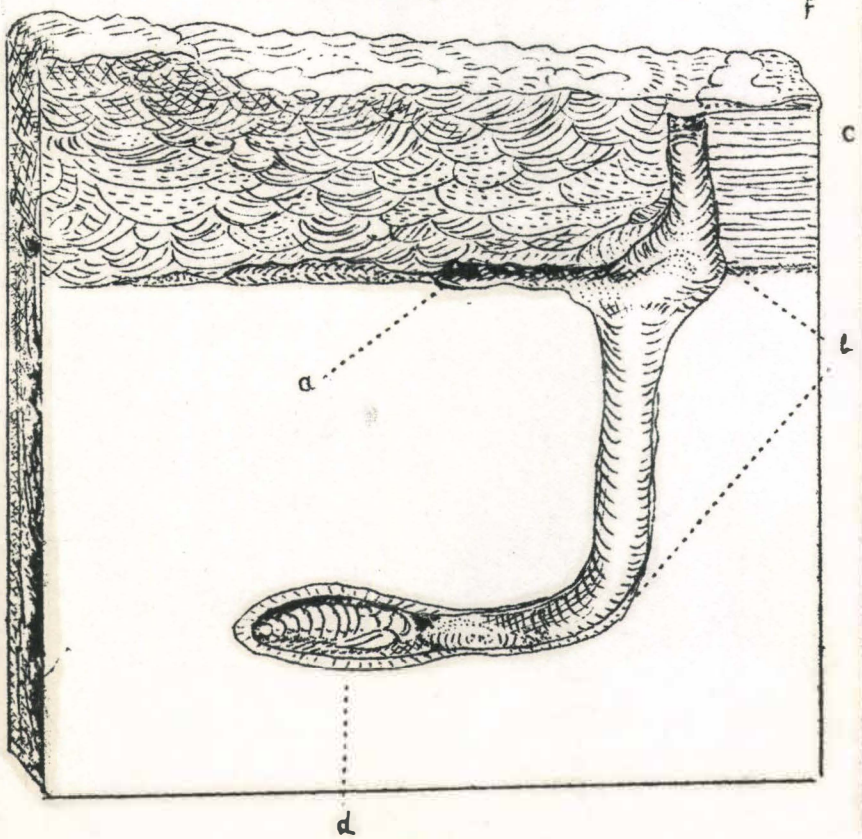


Fig. II

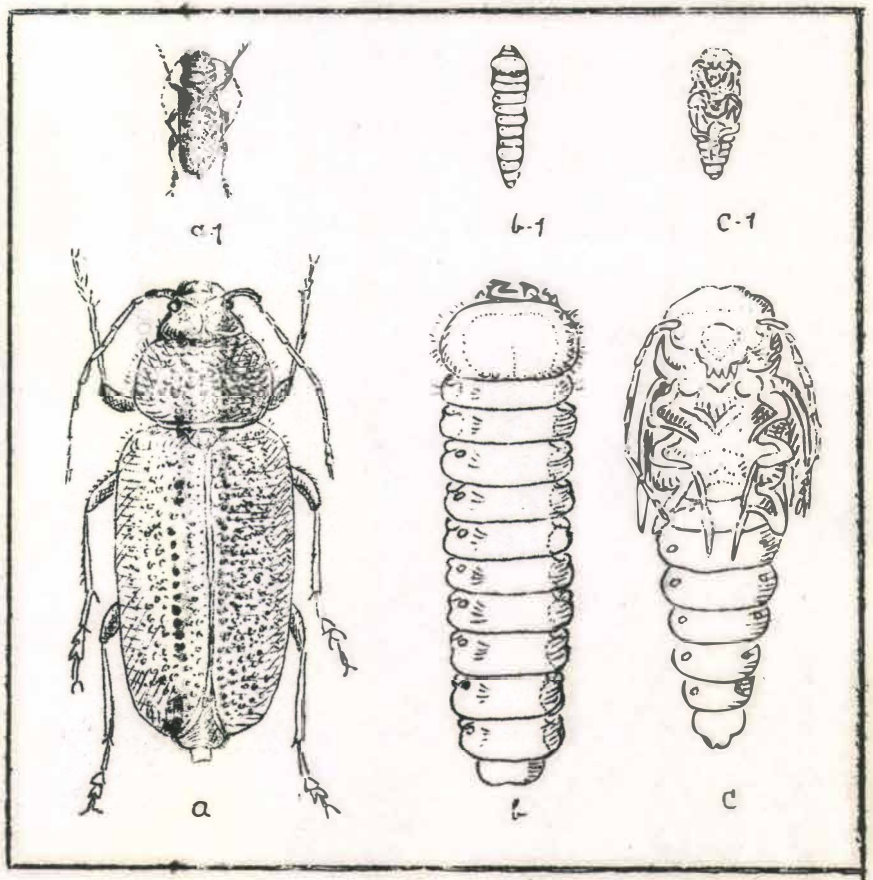


Fig. III